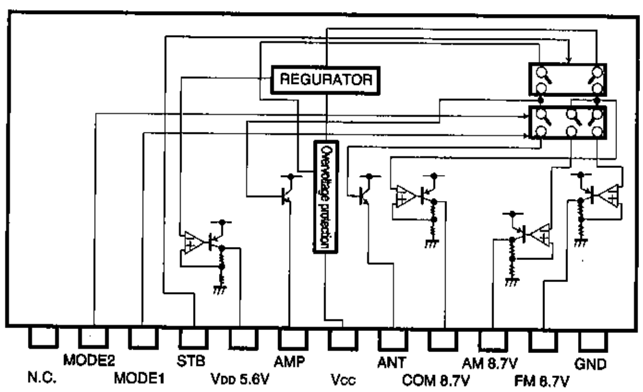
System power supply for car stereos
BA3918

The BA3918 is a one-chip power supply IC for use in car audio systems. One 5.6V output for a microcontroller, three 8.7V outputs, and two outputs interlocked by BACKUP and ACC systems are built in.

●Applications
Car audio systems

●Features
1) All outputs except AMP and ANT use a PNP transistor with a low saturation voltage.
2) Output current limit circuit prevents damage to the IC due to short-circuiting.
3) Overvoltage protection circuit provides protection against surges from the Acc or BACKUP input.
4) Compact 12-pin POWER package allows large power dissipation.
5) Thermal protection circuit prevents heat damage to the IC.

●Block diagram



●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	24	V
Power dissipation	Pd	3000	mW
Operating temperature	Topr	−30~85	℃
Storage temperature	Tstg	−55~150	℃
Peak supply voltage	VccPEAK	50*1	V

*1 Tr ≧ 1 msec, applied time is within 200 msec.

●Recommended operating conditions (Ta=25℃)

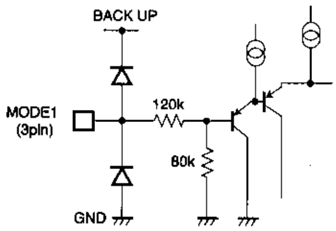
Parameter	Symbol	Min.	Typ.	Max.	Unit
Recommended power supply voltage	Vcc	10	13.2	16	V
Operable voltage *	Vcc	6.3	13.2	24	V

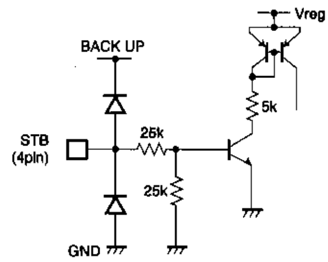
* Not intended to ensure electrical characteristics (in particular, during a voltage drop).

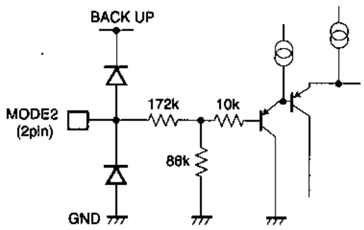
●Pin description

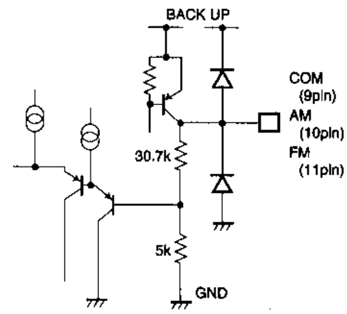
Pin No.	Pin name	Function
1	N. C.	Not used
2	MODE2 SW	AM and ANT outputs are turned ON when this pin is 5 V
3	MODE1 SW	AM and FM outputs are switched when this pin is 5 V
4	STAND BY	Only VDD is output during the 0 V standby state; COM and AM outputs are turned ON when this pin is 5 V
5	VDD output	5.6 V power supply with a maximum output current of 100 mA for a microcontroller; output is always available if BACKUP power supply is connected
6	AMP output	Power supply to activate a remote amplifier; a voltage of about 1 V (typical) lower than the Vcc voltage is provided with a maximum output current of 500 mA
7	Vcc	Connected to car BACKUP and ACC power supplies
8	ANT output	Power supply to drive an antenna; a voltage of about 1 V (typical) lower than the Vcc voltage is provided with a maximum output current of 500 mA
9	COM output	8.7 V power supply with a maximum output current of 150 mA; this can be used as a system common power supply (such as tone, volume, and balance control) or a power supply for cassette player equalizers and electronic tuning variable capacitors
10	AM output	8.7 V power supply with a maximum output current of 150 mA for AM receiver
11	FM output	8.7 V power supply with a maximum output current of 250 mA for FM receiver
12	GND	Connected to the IC substrate.

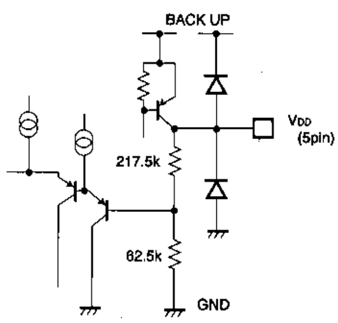
● Input / output circuits

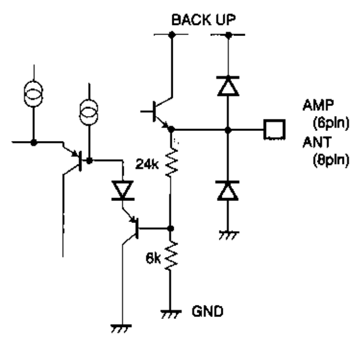












●Electrical characteristics (unless otherwise noted, Ta=25°C and Vcc=13.2V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Standby circuit current	Ist	—	0.55	0.80	mA	STAND BY pin = 0 V
Output voltage (VDD) 1	Vo1	5.30	5.60	5.90	V	Io1=80mA
Voltage variation	ΔVo11	—	5	15	mV	Vcc=10~16V Io1=80mA
Load variation	ΔVo12	—	60	170	mV	Io1=0~80mA
Minimum I/O voltage differential	ΔVo13	—	0.3	0.7	V	Io1=80mA
Output current capacity	Io1	100	200	—	mA	Vo1≧5.3V
Ripple rejection ratio	R.R1	50	60	—	dB	f=100Hz VRR=−10dBV
Output voltage (COM) 2	Vo2	8.25	8.70	9.15	V	Io2=120mA
Voltage variation	ΔVo21	—	10	30	mV	Vcc=10~16V Io2=120mA
Load variation	ΔVo22	—	90	210	mV	Io2=0~120mA
Minimum I/O voltage differential	ΔVo23	—	0.4	0.7	V	Io2=120mA
Output current capacity	Io2	150	300	—	mA	Vo2≧8.25V
Ripple rejection ratio	R.R2	50	60	—	dB	f=100Hz VRR=−10dBV
I/O voltage differential (AMP) 3	ΔVo31	—	1	1.5	V	Io3=400mA
Load variation	ΔVo32	—	350	600	mV	Io3=0~400mA
Output current capacity	Io3	500	900	—	mA	Vo3≧11.7V
I/O voltage differential (ANT) 4	ΔVo41	—	1	1.5	V	Io4=400mA
Load variation	ΔVo42	—	350	600	mV	Io4=0~400mA
Output current capacity	Io4	500	900	—	mA	Vo4≧11.7V
Output voltage (AM) 5	Vo5	8.25	8.70	9.15	V	Io5=120mA
Voltage variation	ΔVo51	—	10	30	mV	Vcc=10~16V Io5=120mA
Load variation	ΔVo52	—	90	210	mV	Io5=0~120mA
Minimum I/O voltage differential	ΔVo53	—	0.4	0.7	V	Io5=120mA
Output current capacity	Io5	150	300	—	mA	Vo5≧8.25V
Ripple rejection ratio	R.R5	50	60	—	dB	f=100Hz VRR=−10dBV
Output voltage (FM) 6	Vo6	8.25	8.70	9.15	V	Io6=200mA
Voltage variation	ΔVo61	—	20	60	mV	Vcc=10~16V Io6=200mA
Load variation	ΔVo62	—	90	210	mV	Io6=0~200mA
Minimum I/O voltage differential	ΔVo63	—	0.4	0.7	V	Io6=200mA
Output current capacity	Io6	250	500	—	mA	Vo6≧8.25V
Ripple rejection ratio	R.R5	45	55	—	dB	f=100Hz VRR=−10dBV

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Input (STAND BY)						
Standby level	Vth1 - 1	—	—	1.1	V	
Active level	Vth1 - 2	1.7	—	—	V	
Input current when HIGH	lin1	100	175	250	μA	Vth1=5V
Input (MODE 2 SW)						
Standby level	Vth2 - 1	—	—	1.6	V	
Active level	Vth2 - 2	2.4	—	—	V	
Input current when HIGH	lin2	13	25	37	μA	Vth2=5V
Input (MODE 1 SW)						
Voltage when AM ON	Vth3 - 1	—	—	1.1	V	
Voltage when FM ON	Vth3 - 2	2.7	—	—	V	
Input current when HIGH	lin3	13	25	37	μA	Vth3=5V

◎ Not designed for radiation resistance.

◎ Set output current to less than the minimum value of output current capacity.

●Input/output timing chart

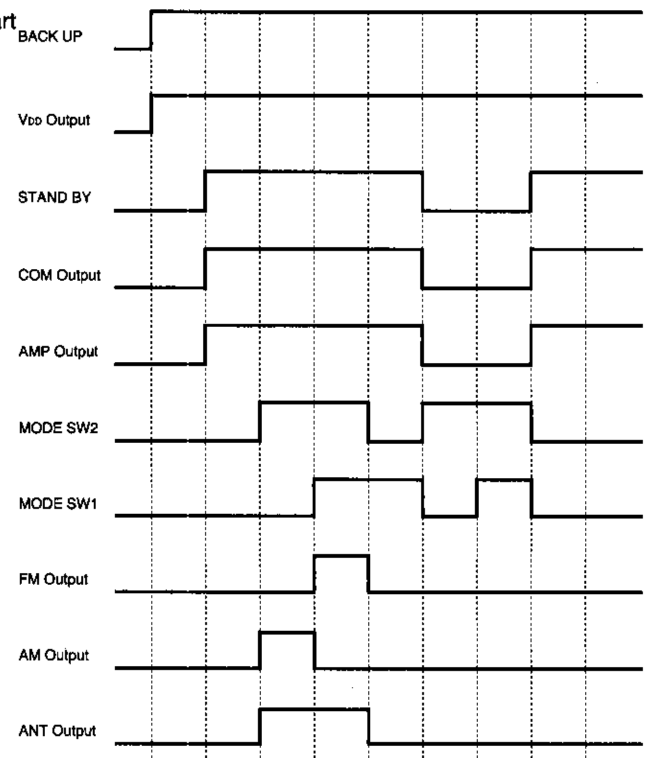


Fig.1

●Power dissipation

Except under transitional conditions, the power dissipation of this IC is 3W per unit at 25℃.
See Fig. 4 for power dissipation characteristics, including some cases where heat sinks are used.

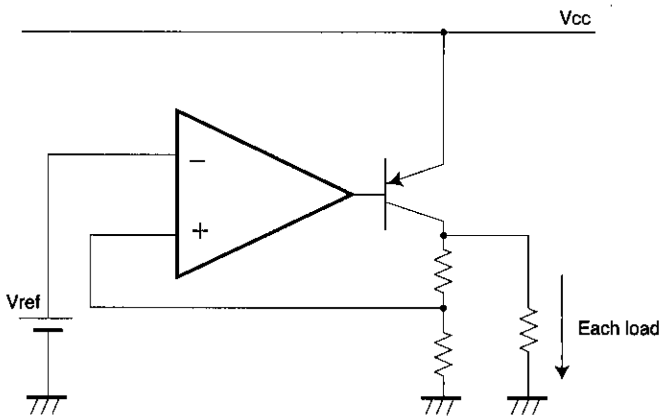


Fig.2

A = maximum voltage for V_{CC}
I_1 = maximum output current for V_{DD}
I_2 = maximum output current for COM
I_3 = maximum output current for AMP
I_4 = maximum output current for ANT
I_5 = maximum output current for AM
I_6 = maximum output current for FM

• Power consumed by V_{DD} 5.6V	$P_1 = (A - 5.6V) \times I_1 + (I_1/20 + I_1/10) \times A$
• Power consumed by COM 8.7V	$P_2 = (A - 8.7V) \times I_2 + (I_2/30 + I_2/10) \times A$
• Power consumed by AMP	$P_3 = 1V \times I_3 + (22mA) \times A$
• Power consumed by ANT	$P_4 = 1V \times I_4 + (22mA) \times A$
• Power consumed by AM 8.7V	$P_5 = (A - 8.7V) \times I_5 + (I_5/30 + I_5/10) \times A$
• Power consumed by FM 8.7V	$P_6 = (A - 8.7V) \times I_6 + (I_2/50 + I_6/10) \times A$
• Power consumed internally by each circuit	$P_7 = V_{CC} \times$ circuit current (about 5mA)

$P_{Max.} = P_1 + P_2 + P_3 + P_4 + (P_5$ or P_6, whichever is greater$) + P_7$

●Application example

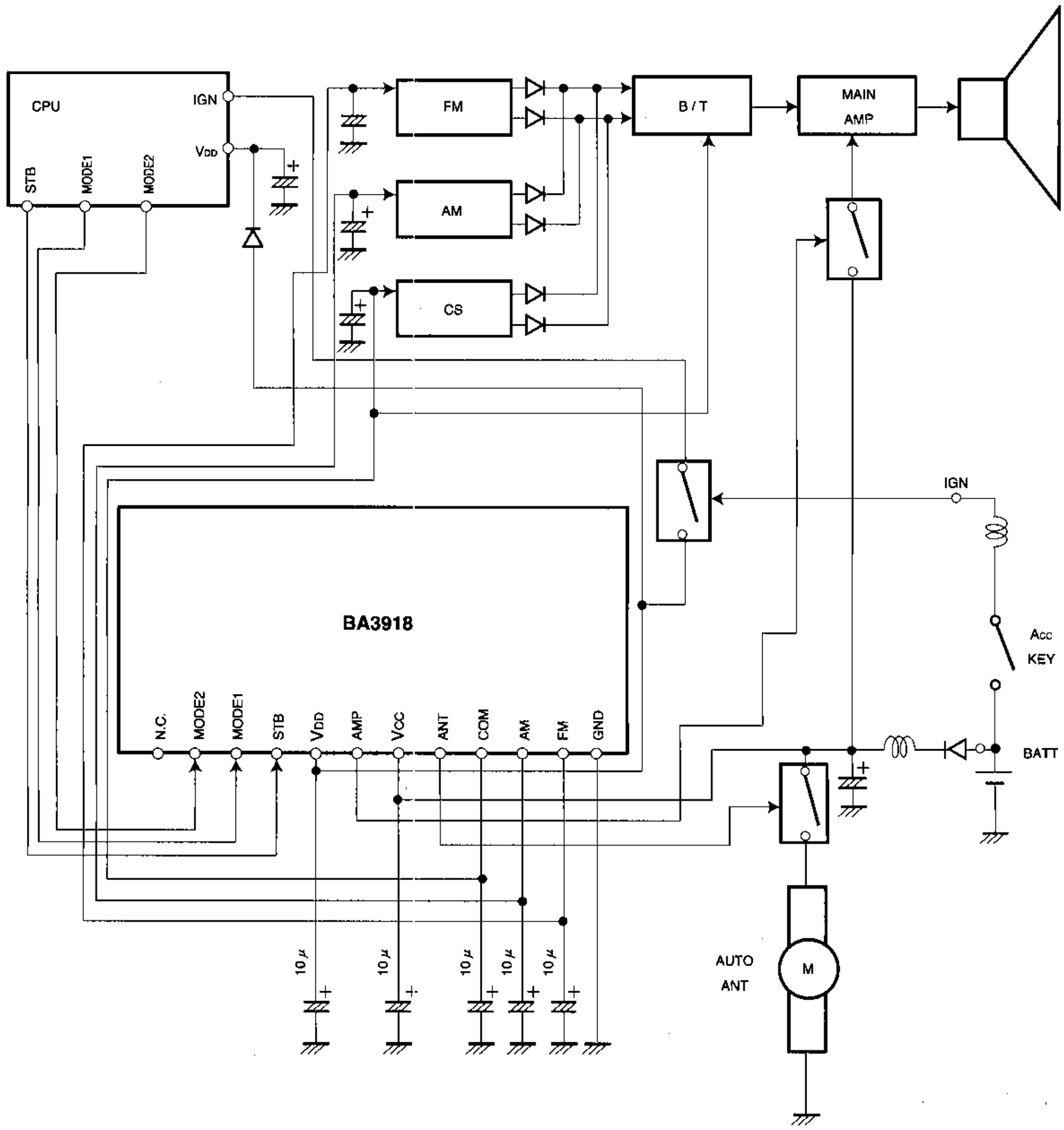


Fig.3

●Operation notes

1. Example of application
   The application circuit of Fig. 3 is recommended for use. Make sure to confirm the adequacy of parts characteristics. When using the circuit with changes to external circuit constants, make sure to leave sufficient margins in consideration of fluctuations in the IC and external components including static and transitional characteristics. Note that ROHM has not carried out extensive survey regarding the patent right of this application.
2. Operating power supply
   When operating within the proper ranges of power supply voltage and ambient temperature, most circuit functions are guaranteed. Although the rated values of electrical characteristics cannot be absolutely guaranteed, characteristic values do not change drastically within the proper ranges.
3. Power dissipation (Pd)
   Refer to the power dissipation characteristics (Fig. 4) and the rough estimation of IC power dissipation given on a separate page. Make sure your design allows a maximum power within the operating temperature range.
4. Overvoltage protection circuit
   The overvoltage protection circuit turns OFF all outputs when the potential difference between V_{CC} (pin 7) and GND (pin 12) is more than about 26V at normal temperature. Make sure to use the IC within this voltage limit.
5. Preventing oscillation at each output
   To stop output oscillation, make sure to connect a capacitor having a capacitance of 10 μF or greater between GND and each of the V_{DD} (pin 5), COM (pin 9), AM (pin 10), and FM (pin 11) output pins. We recommend using a tantalum electrolytic capacitor whose capacitance is unsusceptible to temperature.
6. Overcurrent protection circuit
   An overcurrent protection circuit is installed on the V_{DD} (pin 5), AMP (pin 6), ANT (pin 8), COM (pin 9), AM (pin 10), and FM (pin 11) outputs, based on the respective output current. This prevents IC destruction due to overcurrent, by limiting the current with a curve shape of "7" in the voltage-current graph. The IC is designed with margins so that current flow will be restricted and latching will be prevented even if a large current suddenly flows through a large capacitor. The circuit should be carefully set because output current is further restricted when output voltage is less than 1V_F (considered as short mode).
7. Thermal protection circuit
   A built-in thermal protection circuit prevents thermal damage to the IC. All outputs except V_{DD} are switched OFF when the circuit operates, and revert to the original state when temperature drops to a certain level.
8. Grounding
   Each ground trace in the application circuit of Fig. 3 must be adequately short from GND (pin 12). Make sure to arrange the ground traces in a pattern that prevents mutual interference.
9. Although the quality of this IC is rigorously controlled, the IC may be destroyed when the supply voltage or the operating temperature exceeds their absolute maximum ratings. Because short mode or open mode cannot be specified when the IC is destroyed, be sure to take physical safety measures, such as fusing, if any of the absolute maximum ratings might be exceeded.
10. We recommend installing a bypass line in your application if there is a mode where potential difference between each output and input (V_{CC}) or GND is reversed from the normal state.

●Heat reduction characteristics

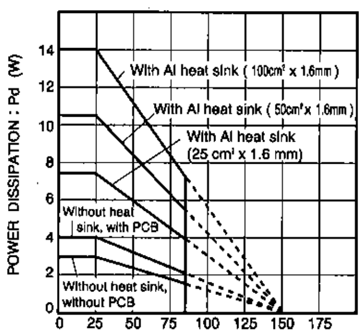


Fig.4

●Electrical characteristic curves

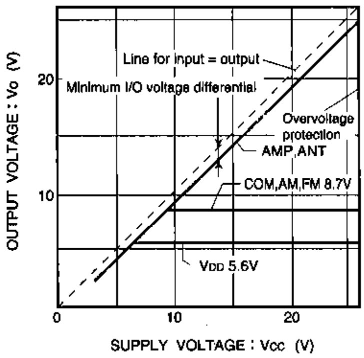


Fig.5 Each output voltage vs. Vcc characteristics

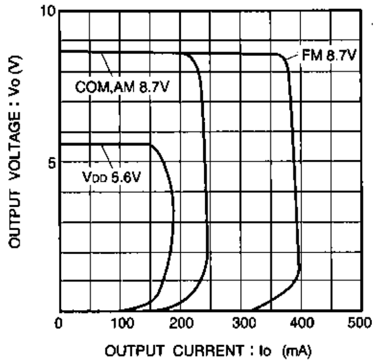


Fig.6 Each output voltage vs. current

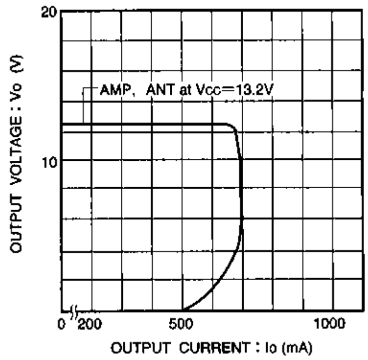


Fig.7 Each output voltage vs. current

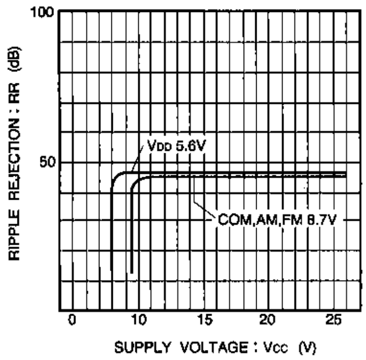


Fig.8 Ripple rejection vs. Vcc characteristics

●External dimensions (Units: mm)

